NVIDIA®

Best Practices for Multi-threading

Eric Young

Developer Technology

GameDevelopers Conference

Overview

- Benefits of Dual-Core
- NVIDIA Multi-threaded Driver
  - OpenGL
  - Direct3D
- Dual-Core Performance Gains
- Summary

Benefits of Dual-Core

- NVIDIA multi-threaded driver
  - Producer & Consumer threads dispatch commands to GPU
  - Improves parallelism between GPU/CPU
  - Performance gains from 10 to 40%
- Application has more computation power available!
  - Handles even more Complex Math, Physics, and AI
  - Add Dual-Core optimizations to your application, and you can achieve up to 2X the performance
  - Best combination:
    - Application has Dual-Core optimizations
    - Running with the multi-threaded driver!

OpenGL on Dual-Core

- Both OpenGL runtime and driver can be completely offloaded
- Application gains 20 to 40% performance
- Driver can dynamically switch between multi-thread and single-thread mode

OpenGL Performance Tips

- Immediate mode for small amounts of vertex data
  ```
  glVertex3f(x, y, z)
  ```
- VBO(s) & Display Lists for large amounts of Vertex Data
- Avoid passing Vertex Pointers
  - Driver will need to copy extra data
  - Use Buffer Objects instead for better performance
- When using VBOs, use element array buffers
  ```
  glBindBufferARB(GL_ELEMENT_ARRAY_BUFFER_ARB,
                  index_buffer);
  ```

OpenGL Performance Tips (contd.)

- Avoid glGetXXX calls or Driver Queries
  - CPU Thread synchronization needed
  - Release builds should not have many `glGetError()` calls
- Do not lock application threads to single CPU
  - OS can do a better job scheduling CPU resources
- Avoid using Vertex Arrays without Buffer Objects
  - Requires a data copy from pointer for every call
  - Driver will have to wait until it is finished using data

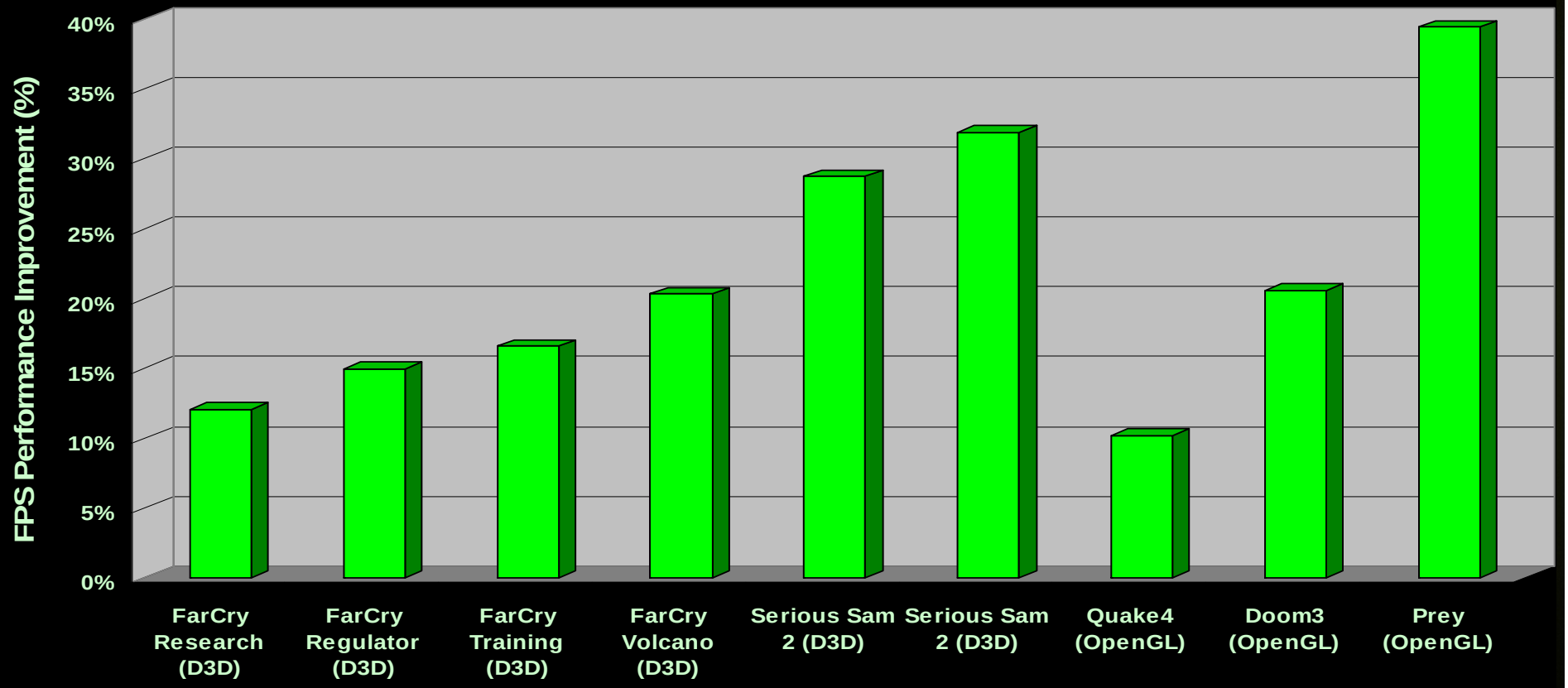
Direct3D on Dual-Core

- Also uses Producer & Consumer threads
- Only driver can be offloaded onto the second CPU
  - Note: Direct3D runtime runs in the application thread
- 10 to 30% performance gains with a multi-threaded NVIDIA driver

Direct3D Performance Tips

- Pack your DrawPrimitive2 calls together
- Frequently creating & destroying shaders, VB, IB, and surfaces will impact performance
- Avoid allocating too many system memory resources
- Minimize use of any locks/unlocks
- Avoid any calls that return GPU state information
  - Requires a CPU thread synchronization
  - Driver Queries are OK (calls are asynchronous)
- Do not lock threads to a specific CPU!

Total Gains with Dual-Core



Summary

- NVIDIA multi-threaded drivers available now
  - Download 84.21 drivers from http://www.nvidia.com
- On a dual-core system 10 to 40% improvement
- Avoid any API calls that return driver state
- Do not lock application threads to a specific CPU
- Applications optimized for dual-core will get even better performance
- We will continue to improve dual-core driver performance

Questions?

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FPS Game Performance